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A PALYNOLOGICAL REPORT ON OIL DEVELOPMENT N.L. PENOLA NO. 1 WELL, SOUTH AUSTRALIA.

by

P.R. EVANS.

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This report outlines the results of a palynological study of core samples and the deepest cuttings from the Penola No.1 well, South Australia.

SUMMARY OF RESULTS

Where sufficient microfossils have been extracted, only Cretaceous sediments are recognized. Coring commenced at 1200 feet; no estimate of age for strata above that level is given. Unfortunately samples from cores 1 - 7 (1200 - 2390 feet) either were barren or yielded no diagnostic spores. Core 8 (2586 - 2596 feet) contained abundant microspores and very rare microplankton; a Lower Cretaceous, (?) Albian age for this horizon is suggested and it gave the only hint of the presence of marine sediments in the bore section. It is possible, however, from recent work on the Port Campbell wells in Victoria (Evans, 1961b) that strata as young as the Cenomanian are represented. Cores 9 to 11 (2790 - 3190 feet) were virtually barren, but cores 12 - 19 (3363 - 4400 feet) generally contained a high proportion of microspores, also of Cretaceous age, which differ from those of core 8 in assemblage composition and which indicate that this interval is low in the Lower Cretaceous. Core 20 gave a moderate yield, considered to be Cretaceous in age, but core 21 (4766 - 4776 feet) provided a low yield of microspores which suggest an age either very low in the Cretaceous or possibly very high in the Upper Jurassic. On the basis of previously defined criteria (Evans, 1961a) for the Jurassic-Cretaceous boundary in eastern Australia, a Cretaceous age is preferred.

OBSERVATIONS

The distribution of the important species which may be compared with described forms is illustrated in the appended table (1). A number of apparently new species, has been observed, particularly from core 12 downwards. However, their presence does not seem to affect any stratigraphic conclusions based on published types. The following characters of the distribution chart are considered to be of stratigraphic significance.

(a) The association of "Zonalapollenites" dampieri and Lycopodiumsporites circolumenus within cores 19, 20 and 21 (4390 - 4776 feet) seems to distinguish an horizon towards the base of the Cretaceous if not in the Upper Jurassic. Neither species is present in abundance, but this association is typical of a

basal zone in the lowest marine strata of the Artesian Basin (Evans, 1961a). Cuttings from 4980 - 4985 feet contained an abundance of microspores which suggest a Cretaceous rather than Jurassic age. However, the presence of Dictyotosporites cf. complex and an increased abundance of Inaperturopollenites indicate an even closer approach to the Jurassic-Cretaceous boundary. This problem is further aggravated by the apparent absence of Cicatricosisporites australiensis below core 13 (3524 feet): this is a species which elsewhere regularly appears first at a level close to the base of the Cretaceous.

(b) Among a wealth of Cyathidites spp. and Lycopodiumsporites spp. between cores 12 and 19 (3363 - 4400 feet) were found many specimens of Granulatisporites dailyi and Dictyotosporites speciosus. They are species which seem to be restricted in geographical distribution to South Australia and Victoria (Cookson & Dettmann, 1958) and which have not yet been found farther away than the southern margin of the Artesian Basin. There, however, they occur low in the marine sequence in probable equivalents of the Cretaceous "Roma Formation". Neoraistrickia truncatus probably ranges no further than the base of the "Tambo Formation". Although there is a very different environment existing in the Penola area to that of the marine Cretaceous of the Artesian Basin (by comparison of gross spore assemblages) it is thus considered that beds between cores 12 and 15 were deposited mainly in Aptian and perhaps partly in Albian times.

(c) Core 8 (2586 - 2596 feet) yielded another assemblage that differs greatly from the lower one in that the previously major component of Cyathidites and Lycopodiumsporites is severely reduced in abundance and that forms such as Cingulatisporites euskirchenoides and Balmeisporites holodictyus are present. Although C. euskirchenoides ranges throughout the Lower Cretaceous, and even into the Cenomanian, it is typical, with B. holodictyus, of the highest marine strata of the Artesian Basin and the overlying freshwater series (Winton Formation). On the same basis as before, an Albian age is suggested for this horizon.

The presence of a few specimens of Micrhystridium sp. imply that a marine influence existed at the time, but the lack of any dinoflagellates cautions that the influence may not have been great.

(d) Lunatisporites limpidus in core 8 and Granulatisporites micronodosus in core 6 (2200 - 2210 feet) suggest that Permian or basal Triassic sediments were being eroded during the Lower Cretaceous. Reworked Palaeozoic spores are characteristic of the Upper Cretaceous and Eocene of South Australia and Victoria (Cookson, 1956), but the Lower Cretaceous beds of the Penola well are the oldest Mesozoic of the area yet known to yield derived fossils of Palaeozoic age.

COMPARISON WITH NEIGHBOURING WELLS

The nearest bores to Penola on which palynological studies have been published were at Nelson and Comaum in Victoria and at Robe and Loxton in South Australia.

The Nelson bore (Baker & Cookson, 1955) penetrated Tertiary and marine Upper Cretaceous sediments, the equivalents of which have not been identified at Penola. Baker and Cookson dated the bore only to a depth of 6233 feet, but samples which have been examined in the Bureau of Mineral Resources to a depth of 7296 feet (total depth of bore 7305 feet) contained a younger microflora than the Cretaceous in the Penola well and it is thought that the Nelson bore never completely penetrated the Upper Cretaceous.

Cookson & Dettmann (1958) examined five samples, covering the interval 1400 - 4300 feet, of the old bore at Robe (drilled by S.A. Oil Wells Co. to a depth of 4504 feet) the spores from which are directly comparable with those distributed through Penola No.1. L. circolumenus, D. speciosus, G. dailyi, Ischyosporites scaberis and Cyclosporites hughesi were common to samples at 3860 feet and 4300 feet in the Robe bore, and are common to the Penola assemblages between cores 12 and 19 (3363 - 4400 feet), particularly to that in core 15 (3917 - 3929 feet). The presence of C. euskirchenoides at 1400 feet and 2630 feet and B. holodictyus at 1400 feet in the Robe bore ally these horizons closely with Penola No.1, core 8 (2586 - 2596 feet).

Two samples from the Comaum bore at 651 and 708 feet and samples from Loxton at 1410 - 1470 feet (Cookson & Dettmann, 1958) approach Penola No.1, core 8, in age.

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TABLE I.

SPECIES	CORE NUMBER (*)																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	19	20	21	A
Pityosporites grandis	+																			
Cyathidites australis	+																			
Inaperturopollenites sp.																				
Granulatisporites cf. micronodosus																				
Gleicheniidites circinidites																				
Microcachryidites antarcticus																				
Araucariacites australis																				
Baculatisporites comaumensis																				
Classopollis torosus																				
Cicatricosisporites australiensis																				
Ginkocycadophytes nitidus																				
Cingulatisporites euskirchenoides																				
Balmeisporites holodictyus																				
Pilosisporites notensis																				
Cirratriradites sp.																				
Lunatisporites limpidus																				
Schizosporis reticulatus																				
Cyath. australis rimalis																				
Lycopodiumsporites austroclavidites																				
Lycopodiumsporites spp.																				
Leptolepidites verrucatus																				
Podocarpidites spp.																				
Dictyotosporites speciosus																				
Cirratriradites filchaensis																				
Sphagnumsporites australiensis																				
Concavisporites cf. juriensis																				
Minerisporites marginatus																				
Neoraistrickia truncatus																				
Podocarpidites micropterus																				
Cyclosporites hughesi																				
Ischyosporites scaberis																				cf.
Lycopodiumsporites cf. rosewoodensis																				
"Zonalapollenites" dampieri																				
Lycopodiumsporites circolumenus																				
Inaperturopollenites cf. limbatus																				
Cicatricosisporites cooksoni																				
Cingulatisporites cf. floridus																				
Dictyotosporites cf. complex																				
Micrhystridium sp.																				

(*) Samples were taken from the following depths:

Core No.	1	1200-1210 feet;	6" - 11" from top,
"	2	1410-1418 " ,	
"	3	1610-1620 " ;	15" from top,
"	4	1805-1815 " ;	8" " " ,
"	5	2010-2020 " ;	top of core,
"	6	2200-2210 " ;	top 2',
"	6	2200-2210 " ;	bottom 2',
"	7	2380-2390 " ;	21" from top,
"	8	2586-2596 " ;	12" " " ,
"	9	2790-2798 " ;	2' " " ,
"	10	2994'8"-2995 " ,	
"	11	3180-3190 " ;	7' " "
"	12	3363-3373 " ;	top 1'6",
"	13	3514-3524 " ;	2'6" from top,
"	14	3715-3715'4",	
"	15	3917-3928 feet,	
"	19	4390-4400 " ,	
"	20	4618'8"-4619 feet,	
"	21	4766-4776 ";	5' from top,
Cuttings	(A)	4980-4985 feet.	